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Notes on the Identity of Small, Brown, Unpatterned Indo-Pacific Moray Eels, with Descriptions of Three New Species (Anguilliformes: Muraenidae)[1]

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ABSTRACT: Eight species of Indo-Pacific morays, including three new species, are described and discussed. Most are plain brown and have unpatterned body coloration (one with small dark spots); they are small to moderate-sized species and possess fewer than 150 vertebrae. They include *Gymnothorax atolli* (Pietschmann, 1935); *Gymnothorax australicola* Lavenberg, 1992; *Gymnothorax herrei* Beebe & Tee-Van, 1933; *Gymnothorax panamensis* (Steindachner, 1876); *Gymnothorax pindae* Smith, 1962; *Gymnothorax pseudoherrei* Böhlke, n. sp.; *Gymnothorax kontodontos* Böhlke, n. sp.; and *Gymnothorax microstictus* Böhlke, n. sp.

MORAYS HAVE FEW external characters that serve to separate species; they have been identified primarily on the basis of fin position, dentition, and coloration, the latter two characters subject to ontogenetic and sexual variation as well as variation due to external factors such as habitat and preservation. Many morays in collections remain incorrectly identified or unidentified as to species, particularly specimens with uniform brown or unpatterned coloration. Recent studies utilizing the vertebral formula (which remains constant for a species), dentition formulas, and sexual condition have aided in characterizing previously described species and in the discovery of several new species.

The need for reexamination and reidentification of unpatterned brown morays is illustrated by recent study of specimens previously identified as *Gymnothorax boschii.* This species was described as *Muraena Boschii* by Bleeker in 1853, based on a small specimen with few diagnostic characters other than its size and uniform color. The name was largely ignored after its description except by Herre (1923:218), who used it for a large brown moray from the Philippines that differed from his new species *Gymnothorax brunneus* [= *G. herrei*] in possessing a single peripheral row of intermaxillary teeth. Herre later deposited specimens (both small and large brown morays identified as *G. boschii*) at Stanford University (since transferred to California Academy of Sciences [CAS]), and additional specimens were so identified by subsequent workers at Stanford and CAS. Fifteen lots identified as that species were borrowed from CAS and found to represent 10 or more species in three genera. Included were very small specimens of *Anarchias* and *Uropterygius* and species of *Gymnothorax* that have now been identified as *G. chilospilus, G. flavimarginatus, G. herrei, G. monochrous, G. pindae, G. pseudoherrei, G. richardsonii,* and *Gymnothorax* sp. (young), plus one lot not yet identified (possibly a new species). Meanwhile I recently reexamined the holotype of *Muraena Boschii,* RMNH 7205, 131 mm TL, and determined it to be *Echidna nebulosa* (Ahl, 1789) based on dentition and vertebral count.

In a previous paper I treated large, elongate, uniformly colored, and unpatterned morays with vertebral counts higher than 150 (Böhlke 1997). A few species of intermediate size and vertebral counts will be treated later when adequate material can be located (e.g., *Gymnothorax angusticaudus* [Weber & de-Beaufort, 1916], MVF 4-59-146; *G. hepaticus*

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[Rüppell, 1830], MVF 5-56-131; and *G. monochrous* [Bleeker, 1856], MVF 5-59-140).

This paper treats eight species of morays that appear to have overall uniform brown coloration (some with white head pores, one with small, indistinct brown spots), three of which are new; they have fewer than 150 vertebrae and are small at maturity (<300 mm, 3 to 400 mm TL). Six of the species are similar in having biserial maxillary and uniserial vomerine dentition; of these, three are unusual in possessing only one branchial pore, and four have serrate teeth. The seventh species has two branchial pores and numerous short, smooth teeth, with triserial maxillary and biserial vomerine dentition; and the eighth (spotted) species has the more usual conditions of two branchial pores, smooth teeth, and uniserial maxillary and vomerine teeth. (A fourth new small moray species, *Gymnothorax castlei,* was recently described [Böhlke and Randall 1999]; it has overall uniform coloration, but is marked with small black spots that form conspicuous lines on the head and along the midline of the body.)

It is hoped that these descriptions and comparisons will aid in identification of the many small, brown, unidentified *"Gymnothorax"* currently housed in collections. They are difficult to identify and almost impossible to determine in the field because some of the characters are not obvious to the naked eye. The pore condition and dentition patterns can be seen only with magnification, and even then it may be difficult; the branchial pores are very small, often obscured by mucus and hard to find, and the outer rows of teeth are small, sometimes embedded, and easily overlooked. Vertebral counts obtained from radiographs must be used to confirm identities. However, the species are valid and distinct, and comparison of various characters, as summarized in Table 1, makes identification possible in the laboratory.

These species are all provisionally placed in the genus *Gymnothorax* sensu lato, as defined in Böhlke et al. (1989). The generic classification of the subfamily Muraeninae is in dire need of revision. Until such study is undertaken, a conservative treatment is used that is based on historical and current recognition of 10 generic names. Nine genera are characterized by specific, readily separable characters (some possibly not deserving generic rank): *Echidna, Enchelycore, Enchelynassa, Gymnomuraena, Monopenchelys, Muraena, Pseudechidna, Rhinomuraena,* and *Strophidon* (see Böhlke and Randall [2000] for generic definitions). The great majority of species are lumped together in the catchall genus *Gymnothorax* (with 14 synonyms). The species described herein do not belong in any of the first nine genera (although some approach species placed in *Echidna,* as do other species retained in *Gymnothorax* sensu lato). Their inclusion in this paper is not meant to signify their relatedness, but rather their similarity in general appearance. There are obvious differences, especially in head osteology and dentition, between many species currently in *Gymnothorax* that should eventually merit generic recognition, resulting in resurrection of some of the names currently in synonymy as well as establishment of new genera. Comprehensive osteological studies are required before such a revision can be accomplished.

MATERIALS AND METHODS

Methods and terminology are as defined in Böhlke (1989). Proportions are expressed in millimeters in terms of total length (TL), measured from the snout tip to the tip of the tail, or head length (HL), from snout tip to the posterodorsal margin of the gill opening. Preanal length is measured from snout tip to midanus; body depth is measured at the gill opening and at the anus and does not include the fins; snout length is measured from snout tip to the anterior margin of the eye; upper-jaw length is from snout tip to the external inner angle of the mouth, lower-jaw length from tip of lower jaw to the external inner angle of the mouth. Head pores typically include three supraorbital pores (one ethmoid at tip of snout plus two supraorbital on dorsal snout), four infraorbital pores along upper jaw, and six mandibular pores along lower jaw, with variation only in one versus

TABLE 1

SUMMARY OF CHARACTERS USED TO SEPARATE SMALL BROWN MORAY SPECIES

CHARACTERS	*atolli*	*australicola*	*herrei*	*panamensis*	*pindae*	*pseudoherrei*	*kontodontos*	*microstictus*
Maximum size (mm)	206	375	247	450	390	292	179	213
Vertebrae								
Predorsal	4–6	5–6	7–11	8–12	5–7	5–9	7–9	4–5
Preanal	51–54	52–56	45–50	50–55	42–46	44–50	40–43	40–44
Total	127–133	141–146	108–122	122–137	110–124	110–118	126–135	113–121
Branchial pores	1	1	1	2	2	2	2	2
Jaw pores	White area	White area	Pale rim	White area	Brown rim	Brown rim	Pale rim	Brown rim
Eye ring	Present	Present	Absent	Present	Present	Absent	Either	Present
Dorsal-fin origin to gill opening	Before	Before	Behind	Behind	Before	Before	Behind	Before
Proportions in TL								
Preanal length	2.1–2.2	2.2–2.5	2.0–2.3	2.0–2.3	2.1–2.4	2.0–2.3	2.5–2.8	2.2–2.4
Head length	7.4–8.3	8.0–9.4	7.0–9.8	7.0–8.5	5.8–7.0	7.2–9.0	8.3–9.7	6.2–7.6
Depth at gill opening	17–22	18–21	14–23	13–20	11–15	14–20	16–20	13–20
Depth at anus	24–27	20–29	16–24	15–24	14–22	16–26	18–22	16–22
Proportions in HL								
Upper jaw	3.0–3.3	2.6–3.1	2.6–3.4	2.7–3.1	2.4–3.0	2.6–3.2	2.5–3.0	2.6–3.0
Snout	5.4–7.0	4.9–5.5	5.4–7.1	5.4–6.1	4.8–6.1	4.9–6.8	4.6–5.4	4.9–6.4
Eye	10–14	8.2–9.3	9.2–11	8.8–14	7.4–13	8.2–12	7.0–8.5	7.2–8.7
Teeth	Serrate	Serrate	Smooth	Serrate	Serrate	Smooth	Smooth	Smooth
Intermaxillary outer	6–6	5–7	5–12	6–8	7–8	6–8	6–7	7–9
middle	0	0	5–7	0	0	0	0	0
median	2	2	2–3	2	2	2	2	2
Maxillary inner	8–14	7–12	8–15	9–19	0–10	8–21	9–13	0–7
middle	0	0	0	0	0	0	8–15	0
outer	15–21	14–22	16–24	16–29	8–18	17–30	12–24	10–18
Vomerine	4–9	7–11	10–14	9–21	9–19	7–12	14–30	9–13
rows	Uniserial	Uniserial	Uniserial	Irregular	Staggered	Staggered	Bi-triserial	Uniserial
Dentary main	12–18	13–20	17–27	17–24	20–29	15–26	19–25	21–31
outer	1–6	4–9	6–20	2–8	0–2	3–22	7–29	0–7

two branchial pores. Vertebral counts were obtained from radiographs as explained in Böhlke (1982); the mean vertebral formula (MVF) is expressed as the mean value for predorsal-preanal-total counts for each species. Tooth counts are approximate and include sockets of missing teeth. Institutional abbreviations follow Leviton et al. (1985). The six species with biserial maxillary dentition are presented first, followed by the two others. Two of the species, *Gymnothorax atolli* and *G. pindae,* have recently been redescribed and their status discussed (Böhlke and Randall 2000); the descriptions are repeated here for comparison with the other species treated in this paper.

TAXONOMY

Gymnothorax atolli (Pietschmann, 1935)
Atoll moray
Figures 1, 2*A*, 3*A*; Table 1

Heteromyrus atolli Pietschmann, 1935: 93 [1938:14, pl. 6 (*C,* 1–2)] (holotype: NMW 65106; type locality: South East Island, Pearl and Hermes Reef, Hawaiian Islands).

DESCRIPTION: A small, moderately elongate moray, depth at gill opening 17–22 and at anus 24–27 in TL; anus before midbody, preanal length 2.1–2.2 in TL. Head moderate, its length 7.4–8.3 in TL; snout short and rounded, overhanging lower jaw, 5.4–7.0 in HL; upper jaw short, 3.0–3.3 in HL; lips papillose. Eye small, 10–14 in HL, notably closer to rictus than to snout tip. Anterior nostril in moderate tube; posterior nostril above and behind anterior margin of eye, with raised crenulate rim. One branchial pore, above and before gill opening. Dorsal-fin origin about midway between rictus and gill opening, above and before branchial pore; gill opening inconspicuous, a diagonal slit at midbody (Figure 2*A*). Predorsal verte-

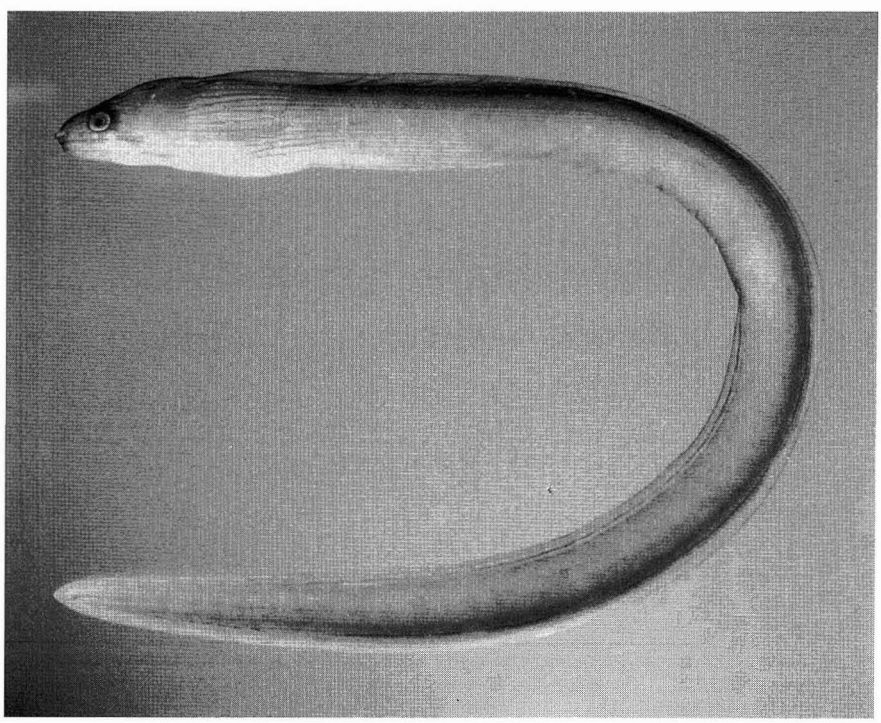

FIGURE 1. *Gymnothorax atolli,* BPBM 34833, 160 mm TL (photo by J. E. Randall).

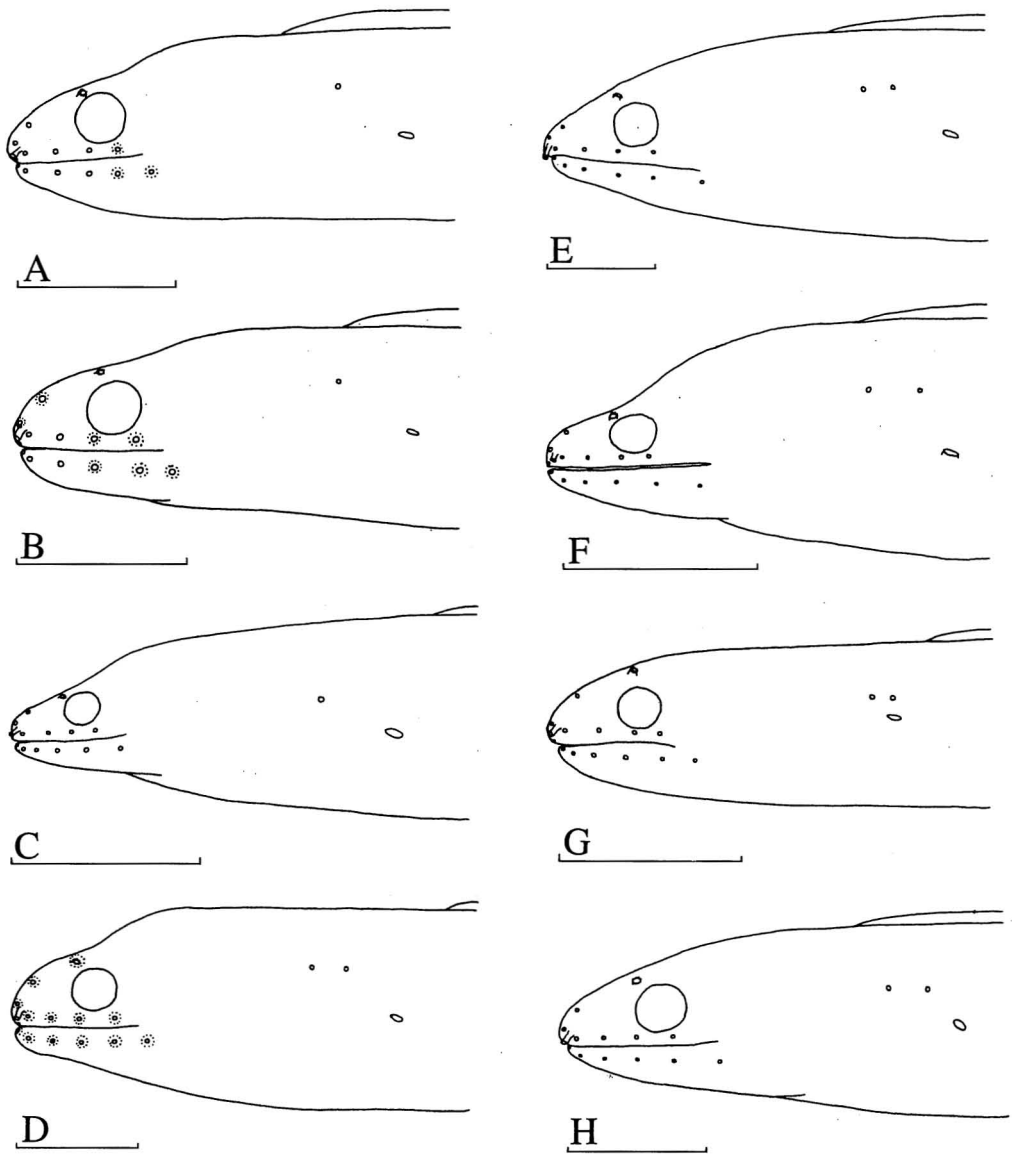

FIGURE 2. Diagrams of heads showing head pores and dorsal-fin origins; scale lines =10 mm: *A. Gymnothorax atolli,* ANSP 176590, 206 mm TL; *B. Gymnothorax australicola,* ANSP 177774, 215 mm TL; *C. Gymnothorax herrei,* ANSP 177768, 161 mm TL; *D. Gymnothorax panamensis,* ANSP 117438, 235+ mm TL; *E. Gymnothorax pindae,* ANSP 144741, 232 mm TL; *F. Gymnothorax pseudoherrei,* ANSP 177769, paratype, 174 mm TL; *G. Gymnothorax kontodontos,* ANSP 177771, holotype, 174 mm TL; *H. Gymnothorax microstictus,* ANSP 177773, paratype, 184 mm TL.

brae 4–6, preanal vertebrae 51–54; total vertebrae 127–133; MVF 5-53-131 (6).

Teeth stout and triangular, largest intermaxillary and dentary teeth serrate; maxillary teeth biserial (Figure 3*A*). Six peripheral intermaxillary teeth, the posterior three large and serrate; 2 median teeth, the second long, thin and depressible. Inner row of 8–14 tall, slender, well-spaced maxillary teeth; outer row of 15–21 short, rounded teeth. On vomer

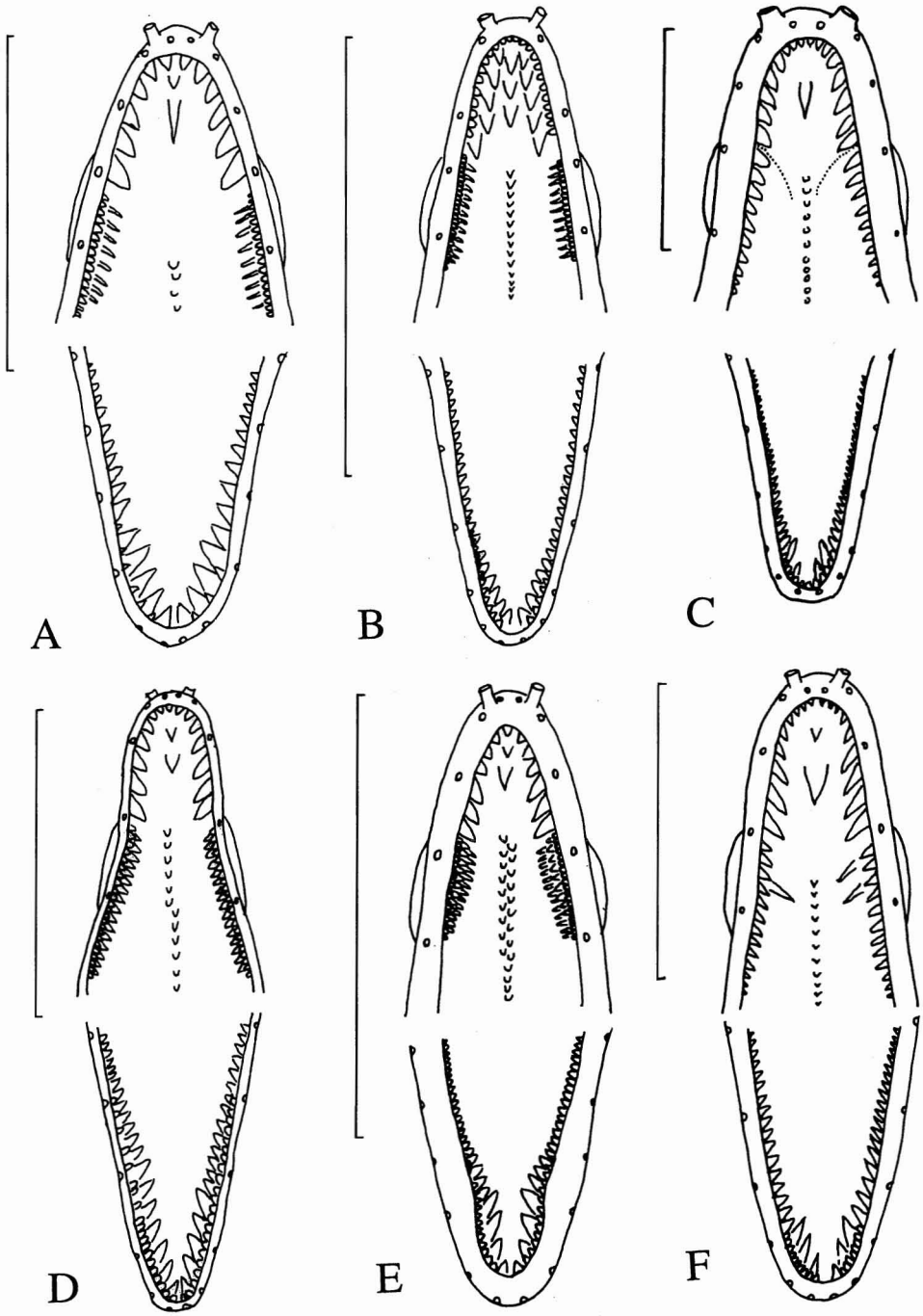

FIGURE 3. Diagrams of dentition; scale lines =10 mm: *A. Gymnothorax atolli,* ANSP 176590, 206 mm TL; *B. Gymnothorax herrei,* ANSP 177768, 161 mm TL; *C. Gymnothorax pindae,* ANSP 144741, 232 mm TL, female; *D. Gymnothorax pseudoherrei,* ANSP 177769, paratype, 174 mm TL; *E. Gymnothorax kontodontos,* BPBM 37448, paratype, 164 mm TL; *F. Gymnothorax microstictus,* ANSP 177773, paratype, 184 mm TL.

4–9 short conical teeth in irregular row. On dentary main row of 12–18 consisting of 3–5 large, triangular, serrate anterior teeth followed by 9–14 progressively smaller teeth; 1–6 small outer teeth flanking the large anterior teeth.

Coloration of head, body, and fins uniform medium brown, posterior fins of large specimens pale. Head sometimes pale ventrally; eye ringed with dark brown pigment. Head pores large and conspicuous, the anterior pores with brown-pigmented rims and the posterior 1–2 upper jaw pores and the last 2–3 mandibular pores in conspicuous white areas; branchial pore small, with fine brown-pigmented rim. Some specimens showing some paler areas (such as the holotype, described with an oblique opalescent spot behind the eye) apparently due to removal of the skin pigment, which is easily abraded. Specimens are frequently coated with mucus.

DISTRIBUTION: All specimens are from the Hawaiian Islands: from Pearl and Hermes Reef in the northern Hawaiian Islands and from Midway Atoll. The Midway specimens were collected at depths to 8 m.

REMARKS: *Gymnothorax atolli* is a small species; the largest known specimen is 206 mm TL, a ripening female with 0.9-mm eggs.

The species is characterized by its overall brown coloration with contrasting white jaw pores, one branchial pore, and biserial maxillary dentition. It is most similar to *Gymnothorax australicola,* which also is a small, brown moray with white jaw pores, one branchial pore, some teeth serrate, and bi-

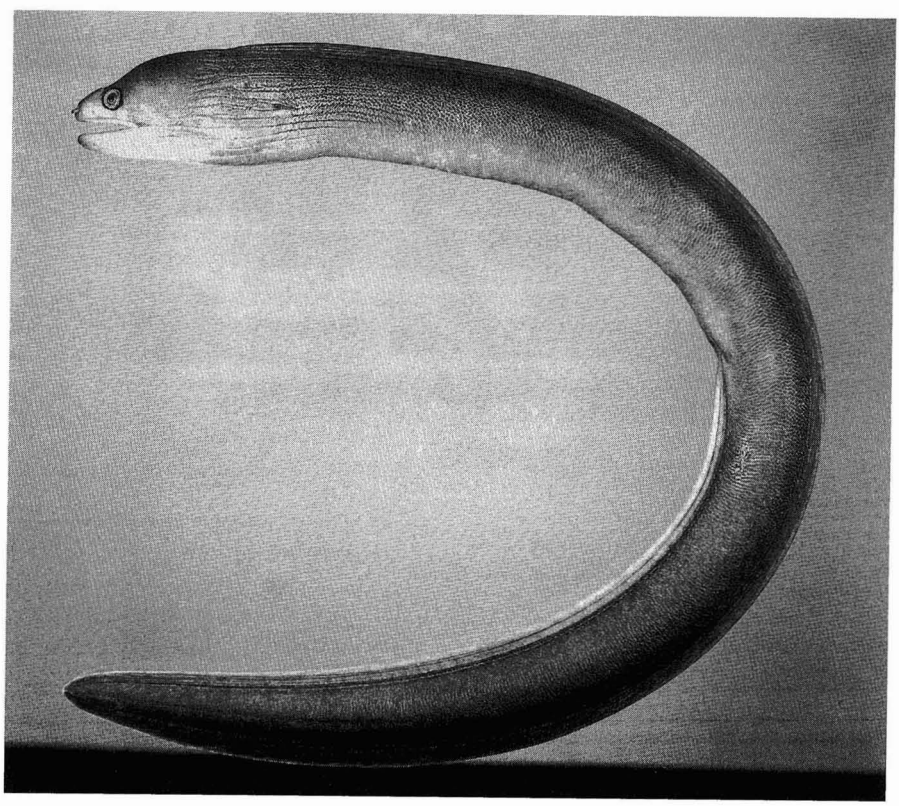

FIGURE 4. *Gymnothorax australicola,* BPBM 6573, 366 mm TL (photo by J. E. Randall).

serial maxillary teeth; *G. australicola* differs in having a shorter preanal length (2.2–2.5 for *australicola* versus 2.1–2.2 for *atolli*) and more vertebrae (MVF 5-53-144 versus 5-53-131, respectively).

This species, described as *Heteromyrus atolli,* was largely ignored after its description until recent reexamination of the holotype indicated that it is a valid species (as discussed in Böhlke and Randall [2000]).

MATERIAL EXAMINED: A total of seven specimens, 75–206 mm TL. HAWAIIAN ISLANDS: Pearl and Hermes Reef: NMW 65106, 192 mm, holotype of *Heteromyrus atolli.* Midway Atoll: ANSP 176590, 206 mm; BPBM 34833, 4:75–160 mm; BPBM 34878, 161 mm.

Gymnothorax australicola Lavenberg, 1992
White-pored moray
Figures 2*B*, 4; Table 1

Gymnothorax australicola Lavenberg, 1992: 59, figs. 1–2 (holotype: LACM 6560-48; type locality: Anakena Cove, Easter Island).

DESCRIPTION: A small, moderately elongate moray, depth at gill opening 18–21 and at anus 20–29 in TL; anus well before midbody, preanal length 2.2–2.5 in TL. Head moderate, its length 8.0–9.4 in TL; snout short and rounded, overhanging lower jaw, 4.9–5.5 in HL; upper jaw short, 2.6–3.1 in HL. Eye moderate, 8.2–9.3 in HL, closer to rictus than to snout tip. Anterior nostril in moderate tube; posterior nostril above anterior margin of eye, with crenulate edge. One branchial pore, above and before gill opening. Dorsal-fin origin between rictus and gill opening, just above branchial pore; gill opening a small diagonal slit at midbody (Figure 2*B*). Predorsal vertebrae 5–6, preanal vertebrae 52–56, total vertebrae 141–146; MVF 5-54-143 (7).

Teeth stout and triangular, largest intermaxillary and dentary teeth serrate; maxillary teeth biserial (dentition similar to that of *Gymnothorax atolli* [Figure 3*A*]). Outer intermaxillary teeth 5–6 plus usually one center tooth; 2 taller teeth on midline. Inner row of 7–12 tall, slender, well-spaced maxillary teeth; outer row of 14–22 short, close-set teeth. Vomerine teeth 7–11, sometimes slightly staggered. Main row of 13–20 dentary teeth, large and serrate anteriorly, decreasing in size posteriorly, plus 4–9 small outer teeth anteriorly in small specimens.

Coloration of head, body, and fins uniform medium to dark brown, the fins slightly pale posteriorly. Eye with dark ring; anterior jaw pores with brown-pigmented rims; other head pores, usually the two dorsal supraorbital pores, the last two pores on the upper jaw, and the last two to three pores on the lower jaw in conspicuous white areas.

DISTRIBUTION: A trans-Pacific species, found in tropical to subtropical temperate waters from Easter, San Felix, and San Felipe Islands in the eastern Pacific, and the Pitcairn Group, Rapa, Ducie Atoll, and Lord Howe Island. It has been taken in tide pools and at depths to 45 m.

REMARKS: *Gymnothorax australicola* is a moderately small species; the largest specimen recorded is 375 mm. Of eight study specimens, three are females (180–254 mm), the largest with 0.8-mm eggs.

This species is characterized by its uniform brown coloration with contrasting white head pores and its single branchial pore. For many years it was identified as *Gymnothorax panamensis,* the eastern Pacific species that also has white jaw pores, but it has all head pores white and a large dark "mask" around the eye, possesses two branchial pores, has the dorsal-fin origin farther back, and has fewer vertebrae (MVF 10-52-130). *Gymnothorax australicola* is even more similar to *G. atolli* from Hawai'i, which also has only one branchial pore and similar coloration, but has the anus closer to midbody and more vertebrae (see previous species).

MATERIAL EXAMINED: Eight specimens, 130–259 mm TL. EASTER ISLAND: ANSP 165743, 259 mm, paratype of *Gymnothorax australicola.* PITCAIRN GROUP: Pitcairn Island, BPBM 16991, 2:145–155 mm; BPBM 17036, 3:130–254 mm. RAPA: ANSP 177774, 215 mm; BPBM 17259, 180 mm.

Gymnothorax herrei Beebe & Tee-Van, 1933
Small brown moray
Figures 2*C*, 3*B*; Table 1

Gymnothorax brunneus Herre, 1923:212, fig. 13 (holotype: BSMP, destroyed; type locality: "Probably Puerto Galera, Mindoro, Philippines") [name unavailable, preoccupied by *Gymnothorax brunneus* Nichols, 1920].

Gymnothorax herrei Beebe & Tee-Van, 1933:138 (neotype: ANSP 164931; type locality: Analao, Batangas, Philippines) [replacement name for *Gymnothorax brunneus* Herre, 1923, preoccupied].

DESCRIPTION: A small species, laterally compressed, depth at gill opening 14–23 and at anus 16–24 in TL; anus before midbody, preanal length 2.0–2.3. Head 7.0–9.8 in TL; snout short, 5.4–7.1 in HL; jaws equal, upper jaw length 2.6–3.4 in HL. Eye above midgape, closer to rictus than to snout tip, 9.2–11.0 in HL. Anterior nostril in moderate broad tube, just reaching lip edge; posterior nostril above or just before anterior margin of eye, with raised crenulate rim. Head pores conspicuous; a single branchial pore above and well before gill opening. Dorsal-fin origin above or shortly behind gill opening, well behind branchial pore. Gill opening a diagonal slit at midside (Figure 2*C*). Predorsal vertebrae 7–11, preanal vertebrae 45–50, total vetebrae 108–122; MVF 9-47-114 (28).

Teeth smooth and numerous, no long canines (Figure 3*B*). Intermaxillary teeth in 5 rows across anteriorly; outer row of 5–12 short, rounded teeth, main row of 5–7 stout teeth, increasingly larger and triangular posteriorly, and 2–3 stout teeth on midline. Maxilla very short, its end just below posterior eye; two rows of teeth along entire extent; inner row of 8–15 tall, slender, well-spaced teeth, outer row of 16–24 short, rounded, close-set teeth. Both vomerine and dentary tooth rows extending beyond maxillae to rictus; vomerine teeth 10–14, short and stout. Dentary teeth biserial anteriorly or biserial for most of extent; main row of 17–27 stout triangular teeth, decreasing in size posteriorly, flanked by outer row of 6–20 small, close-set teeth with pointed tips, extending partway back in some individuals, the row almost complete in others.

Most specimens dark brown, often covered with heavy mucus; head slightly paler. Head pores with narrow unpigmented rims, sometimes appearing pale, but not in large white areas.

DISTRIBUTION: This species has been taken in Indonesia, the Philippines, and Singapore; collected at shallow depths recorded to 3 m.

REMARKS: *Gymnothorax herrei* is a small species, the largest specimen 247 mm TL, maturing at a small size. One collection of 31 specimens (53–201 mm, ANSP 164926 and USNM 357448) from Halmahera Island contains mature individuals and may be a spawning group; of a total of 13 females (127–182 mm), 10 (127–180 mm) are ripe, 7 (127–180 mm) greatly distended with 1.5- to 2.0-mm hydrated eggs, and 4 specimens (146–201 mm) are males.

This species is readily identified by its overall dark brown coloration, the single branchial pore, the dorsal-fin origin over or behind the gill opening, and the extra outer row of intermaxillary teeth. The identity of *Gymnothorax herrei* was uncertain for many years after its description; Herre's holotype of *G. brunneus* was destroyed during World War II. The species was redescribed and spawning behavior discussed by Ferraris (1985); the identification of his specimens was based on the original description and by comparison with one specimen identified as *brunneus* by Herre in 1931 (SU 26842). The branchial pore condition was not noted by Herre, but a single pore was listed by Ferraris and depicted on his Figure 2. The extra peripheral row of intermaxillary teeth was noted in Herre's key to species (p. 207), where he separated *brunneus* [= *herrei*] and *meleagris* from other species with the usual 3 rows (including his *"boschii"*), but his description listed 15 stout intermaxillary teeth and 2 median teeth, without comment. Ferraris said "premaxillary tooth patch with a marginal row of 12–14 (15) teeth and 3 (2) mesially," both peripheral rows evidently included in his anterior "patch." Both Herre's

and Ferraris' specimens are included in the material studied; the intermaxillary teeth were counted as five rows across.

Gymnothorax herrei is most similar in size and general appearance to *G. pseudoherrei* Böhlke, n. sp., described later in this paper, which has similar coloration and biserial maxillary dentition, but which has two branchial pores, the dorsal-fin origin before the gill opening, and three rows of intermaxillary teeth. Some specimens recently identified as *G. herrei* are, in fact, *G. pseudoherrei.* Because of the similarity of the two species, a neotype is here designated for *G. herrei,* as listed below. Its counts and measurements are typical and are included in the description above; its VF is 8-47-113.

Muraena vagrans Seale, 1917, known only from the holotype, MCZ 2532B, from "South America?," has very similar dentition. The holotype is large (544 mm) and completely dark, in poor condition, partially digested internally and perhaps desiccated at some time, but with excellent teeth that fit the description of those of *herrei.* However, in addition to its large size, it has an elongate body with long tapering tail, a large head with elevated occiput, the dorsal-fin origin well forward on the head between gill opening and rictus, anus shortly before midbody, and approximate vertebral counts of 3-56-139 (the dorsal fin has been dissected, and several vertebrae are anomalous); it could not be confused with *herrei.* It is therefore considered to be a valid species, *Gymnothorax vagrans* (Seale), known only from the holotype, from an unknown locality (other species described in the same paper are from the western Atlantic, eastern and western Pacific, and Indian Oceans).

TYPE MATERIAL: Neotype: ANSP 164931, 150 mm, a ripe female; Analao, Batangas, Philippines, 13° 45′ N, 120° 55′ E, 0–3 m; C. J. Ferraris, 25 April 1980 (new designation).

OTHER MATERIAL EXAMINED: A total of 56 specimens, 53–247 mm TL. PHILIPPINES: ANSP 175434, 176 mm. Batangas: CAS 46361, 4:112–131 mm. Palawan Province: SU 26800, 207 mm; SU 26842, 191 mm; SU 38881, 212 mm; USNM 357447, 121 mm. INDONESIA: BMNH 1867.11.28.269, 247 mm. Borneo: USNM 357446, 144 mm. Celebes: BPBM 26738, 149 mm; Halmahera Island: ANSP 164926, 15:53–201 mm; ANSP 164929, 150 mm; ANSP 177768, 161 mm; USNM 357448, 16:80–177. SINGAPORE: ROM 41156, 231 mm; SU 30801, 9:131–237 mm. SRI LANKA: Trincomalee: USNM 357445, 178 mm.

Gymnothorax panamensis (Steindachner, 1876)
Masked moray
Figures 2*D*, 5; Table 1

Muraena panamensis Steindachner, 1876:67 (holotype: NMW, missing; type locality: Panama [Pacific].
Lycodontis umbra Fowler, 1944:317, figs. 66–68 (holotype: ANSP 70025; type locality: James Island, Galápagos Islands).

DESCRIPTION: A medium-sized moray, depth at gill opening 13–20 and at anus 15–24 in TL; anus before midbody, preanal length 2.0–2.3. Head large, 7.0–8.5 in TL; snout short and blunt, 5.4–6.1 in HL; upper jaw slightly overhanging lower, 2.7–3.1 in HL. Eye moderately large, 8.8–14 in HL, closer to rictus than to snout tip. Anterior nostril in moderate tube; posterior nostril above anterior eye, with crenulate rim, slightly raised in largest specimens. Two branchial pores above and well before gill opening. Dorsal-fin origin above or (usually) behind gill opening, well behind second pore. Gill opening a diagonal slit at or just below midside (Figure 2*D*). Predorsal vertebrae 8–12, preanal vertebrae 50–55, total vertebrae 122–137; MVF 10-52-130 (25).

Teeth stout and triangular, largest intermaxillary and dentary teeth serrate; maxillary teeth biserial (dentition similar to that of *Gymnothorax atolli* [Figure 3*A*], but teeth more numerous). Peripheral row of 6–8 intermaxillary teeth, the anterior 3 short, the posterior teeth large, stout, triangular and directed back, the edges slightly serrate on largest specimens; two median intermaxillary teeth. Inner row of 9–19 tall, slender maxillary teeth, outer row of 16–29 short, small

FIGURE 5. *Gymnothorax panamensis,* ANSP 117438, 235+ mm TL; head.

teeth, sometimes a few median teeth forming a third row. Vomerine teeth stout and pointed, on conspicuous ridge, 9–21 in irregular row or with a few biserial. Main row of 17–24 large, stout dentary teeth, decreasing in size posteriorly, the large anterior teeth serrate, enclosed by 2–8 shorter outer teeth anteriorly.

Appearing as a plain, dark brown moray, with snout, abdomen, and fins slightly paler. Head marked with conspicuous dark ring around eye that extends ventrally and posteriorly to form a "mask" in well-marked specimens (Figure 5). Posterior nostril and all head pores in conspicuous white areas, which contrast with the dark eye mask; branchial pores with narrow brown rims. Some specimens appear faded or dark all over, with the head marks inconspicuous, because of heavy mucous covering. A very few small specimens with little mucus had the body color mottled with small, indistinct, irregular dark blotches.

DISTRIBUTION: Found only in the eastern Pacific, from Mexico to Ecuador; usually taken in shallow waters to 9 m.

REMARKS: *Gymnothorax panamensis* is a moderate-sized species; the largest specimen is 450 mm. Of 10 study specimens, two (177–280 mm) are females with eggs to 1.1 mm diameter, and five (225–435) are males.

This species is easily identified by the dark brown color and the contrasting white head pores, the posterior dorsal-fin origin behind the gill openings, and the dentition pattern. For many years specimens from the central Pacific were identified as this species, but Lavenberg (1992) demonstrated that these were a different species, which he described as *G. australicola,* with the dorsal fin originating on the head before the gill opening

and above vertebrae 3–6, only the posterior jaw pores white, a single branchial pore, and with more vertebrae (MVF 4-51-142).

Steindachner described *Muraena panamensis* based on one specimen of "11 zoll" (ca. 11 in.) in the Vienna Museum; the type cannot be found. Two specimens in NMW 4725, labeled "*Muraena,* Panama?; Steindachner; 1874.I," were examined and found to be this species, based on proportions, dentition, and vertebral counts, but both are too small to be the holotype. The holotype of Fowler's *Lycodontis umbra* is very small, faded, and shriveled (perhaps desiccated at some time), medium brown with the white rims of the head pores and posterior nostrils just visible; the dentition, vertebral count, and pore condition confirm its identity as *Gymnothorax panamensis.*

MATERIAL EXAMINED: A total of 60 specimens, 54–450 mm TL. MEXICO: Gulf of California: ANSP 138148, 9:61–225 mm. PANAMA: ANSP 14595, 280 mm; NMW 4725, 2:83–108 mm. Pearl Islands: ANSP 80974, 222 mm. COLOMBIA: Gorgona Island: ANSP 109971, 2:64–164 mm. ANSP 127615, 5:54–164 mm. ECUADOR: La Plata Island: ANSP 109851, 2:178–191 mm. ANSP 109852, 137 mm; ANSP 109994, 65 mm; ANSP 109999, 109 mm. Galápagos Islands: ANSP 109847, 176 mm. Baltra Island: ANSP 117437, 276 mm. Fernandina Island: ANSP 109865, 67 mm; ANSP 131412, 15:80–365 mm. Isabela Island: ANSP 131401, 9:69–450 mm. James Island: ANSP 70025, 80 mm, holotype of *Lydocontis umbra.* Marchena Island: ANSP 109848, 3:55–121 mm. Narborough Island: SMF 7394, 1. San Salvador: ANSP 117438, 3:99–264 mm.

Gymnothorax pindae Smith, 1962
Pinda moray
Figures 2*E*, 3*C*, 6; Table 1

Gymnothorax pindae Smith, 1962:430, pl. 55 (fig. D) (holotype: RUSI 105; type locality: Pinda, Mozambique).

DESCRIPTION: A stout species with tapering tail, depth at gill opening 11–15 and at anus 14–22 in TL; anus before midbody, preanal length 2.1–2.4 in TL. Head elongate and massive, its length 5.8–7.0 in TL; snout moderate, 4.8–6.1 in HL; jaws moderate, upper jaw 2.4–3.0 in HL. Eye large, above midgape, closer to rictus than snout tip, 7.4–13 in HL. Anterior nostril in long tube; posterior nostril above and behind anterior margin of eye, with raised rim directed back, slightly crenulate in larger specimens. Two branchial pores shortly before gill opening. Dorsal-fin origin between rictus and gill opening, well before anterior branchial pore; fin rays long posteriorly on tail, caudal rays unusually long. Gill opening at midside or slightly above (Figure 2*E*). Predorsal vertebrae 5–7, preanal vertebrae 42–46, total vertebrae 110–124; MVF 6-44-121 (21).

Teeth variable with size of specimens, maxillary teeth biserial in small individuals, uniserial in adults; largest anterior teeth on both jaws serrate (Figure 3*C*). Peripheral intermaxillary teeth usually 7–8, the anterior 3 smaller, posterior 4–5 large, stout, and serrate; usually 2 (varying 1–3) teeth on midline. Maxillary teeth of small specimens (122–165 mm) consist of inner row of 5–10 long, slender, spaced teeth, outer row of 14–18 very small embedded teeth, the rows about equal in length; 208- to 225-mm specimens with 1–2 long inner teeth anteriorly and outer row of 8–14 small teeth; large individuals (212–302 mm) have no inner maxillary teeth, a single row of 8–12 triangular teeth that are large anteriorly, becoming progressively smaller posteriorly, the large anterior teeth serrate. Vomerine teeth 9–19, small, embedded and difficult to find, sometimes staggered medially. On dentary main row of 20–29 stout, triangular teeth, the first 1–3 teeth very large and serrate, then decreasing in size posteriorly; a few small outer teeth anteriorly.

Coloration uniform dark brown, becoming black posteriorly on tail and fins; head and ventral body not pale. Diffuse dark brown ring around eye; head pores and posterior nostril with narrow brown rims. Eye ring and brown rims of head pores not always visible.

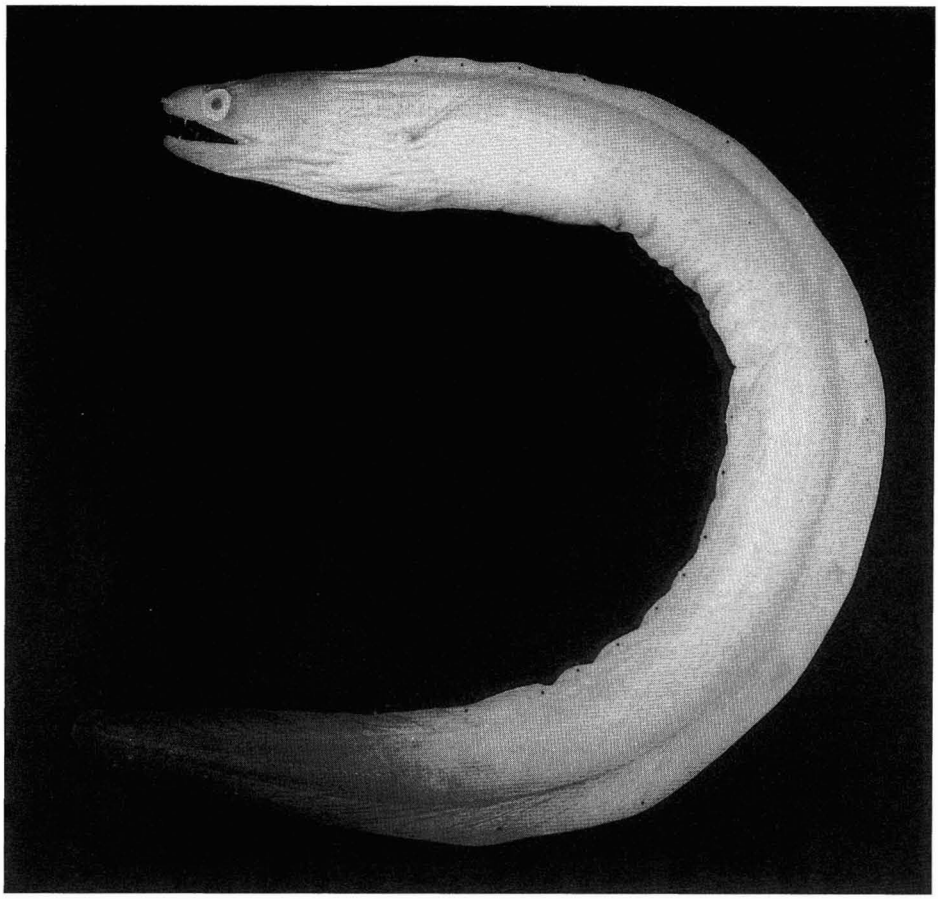

FIGURE 6. *Gymnothorax pindae,* BPBM 6950, 178 mm TL (photo by J. E. Randall).

DISTRIBUTION: Found throughout the Indo-Pacific from the Pitcairn Group and Johnston Island to the west coast of Africa; taken on coral reefs off islands at depths to 40 m.

REMARKS: *Gymnothorax pindae* is a moderate-sized moray, reported to 390 mm, sexually mature at 150 mm. Sex was determined for 27 specimens; 13 (122–302) are females, of which 8 (151–275) are ripe with 0.8- to 1.7-mm eggs; 14 (132–329) are males.

A distinctive species, with its large, deep head and sharply tapering, very dark tail. It is seldom misidentified (although Schultz et al. [1953 : 113] and subsequent workers following them identified specimens as *G. moluccensis* until 1975 when Randall and McCosker [1975 : 18] corrected the error). Adult *pindae* differ from the other species treated here in having uniserial maxillary dentition.

MATERIAL EXAMINED: A total of 52 specimens, 72–389 mm TL; data obtained from 20 specimens, 132–327 mm. HAWAIIAN ISLANDS: Hawai'i: BPBM 37447, 285 mm. JOHNSTON ISLAND: BPBM 8955, 4: 190–254 mm. PITCAIRN GROUP: Pitcairn Island: BPBM 16694, 264 mm. MARSHALL ISLANDS: Majuro Atoll: BPBM 17738, 8: 89–174 mm. FIJI: Mbengga Island: BPBM

14568, 257 mm. SOLOMON ISLANDS: Tautsina Island: ANSP 131987, 122 mm. SANTA CRUZ ISLANDS: Vanikoro Island: ANSP 133114, 208 mm. LOYALTY ISLANDS: Uvea: BPBM 27073, 389 mm. MARIANA ISLANDS: Guam: BPBM 6950, 178 mm. NEW BRITAIN: Kerawara Island, Duke of York Group: ANSP 131173, 213 mm. Rabaul: ANSP 131176, 275 mm. AUSTRALIA: Great Barrier Reef: BPBM 14397, 308 mm. PAPUA NEW GUINEA: Hermit Islands: ANSP 144741, 3:232–291 mm; ANSP 144751, 213 mm; ANSP 144755, 4:182–254 mm; ANSP 144756, 139 mm. Massas Island: ANSP 131413, 322 mm. Ninigo Islands: ANSP 144423, 2:275–329 mm; ANSP 144424, 141 mm; ANSP 144752, 275 mm. PALAU: Bairakaseru: BPBM 10193, 295 mm. Eil Malk: BPBM 17665, 151 mm. PHILIPPINES: Siquijor Island: ANSP 141338, 212 mm. Palawan Province: ANSP 141339, 2:165–257 mm. Luzon: ANSP 144530, 72 mm. INDONESIA: Siberut Island: ANSP 176122, 222 mm. SRI LANKA: Galli: ANSP 138703, 2:151–210 mm. Hikkaduwa: ANSP 138712, 108+ mm. SEYCHELLES: Amirante Islands: ANSP 131981, 268 mm, cleared and stained. ANSP 138577; 187 mm. MAURITIUS: ANSP 131988, 302 mm. COMOROS: Anjouan Island: ANSP 131408, 175 mm. Grande Comore Island: ANSP 131984, 185 mm. MOZAMBIQUE: Pinda: RUSI 105, 327 mm, holotype of *Gymnothorax pindae.*

Gymnothorax pseudoherrei Böhlke, n. sp.
False small brown moray
Figures 2*F*, 3*D*, 7; Table 1

Gymnothorax herrei (non Beebe & Tee-Van) Randall, 1995:56, middle fig. (Oman).

TYPE MATERIAL: Holotype: USNM 357430, 147 mm TL, female; Philippines, Mindanao, Zamboanga Del Norte, W side of Solino (Selinog) Island, 08° 51′ 24″ N, 123° 24′ 36″ E, 0–4.6 m; L. Knapp et al., LK79-7; 3 May 1979. Paratypes: A total of 101 specimens, 46–292 mm TL; data from 20, 123–292 mm TL. SOLOMON ISLANDS: ANSP 138525, 5:90–134 mm, Tautsina Island, E of Kieta Peninsula, coral head, 1–8 m; *Te Vega* Cruise 6, sta. 247; 11 March 1965. NEW BRITAIN: ANSP 131136, 11:74–134 mm; Dawapia Rocks, Rabaul, near entrance to Simpson Harbor, 14° 14′ 05″ S, 152° 10′ 25″ E; *Te Vega* Cruise 6, sta. 235; 27 February 1965. AUSTRALIA: Queensland: ANSP 144601, 2:145–182 mm; middle of N side of E half of Endeavour Reef, 1–2 m; J. C. Tyler, C. L. Smith, TSA-13; 13 January 1969. PAPUA NEW GUINEA: ANSP 145110, 109 mm; Trobriand Islands, Kiriwana Island, W side of Boli anchorage, 08° 31′ 48″ S, 150° 59′ 48″ E; B. B. Collette et al., BBC-1694; 16 June 1979. USNM 357431, 2:127–156 mm; Louisade Archipelago, SW shore of Panapompom Island, 10° 47′ S, 152° 24′ E, 0–6 m; B. B. Collette et al., BBC-1693; 15 June 1979. PALAU: CAS 208442, 3:118–154 mm; lagoon edge of barrier reef 8 miles NW of Korror Island, 07° 24′ 30″ N, 134° 21′ 20″ E, 1–2 m; R. R. Harry [Rofen] et al., GVF 25-524; 19 July 1955. PHILIPPINES: ANSP 144451, 7:102–148 mm; Palawan Province, Sulu Sea, Puerto Princesa Bay, 09° 48′ N, 118° 44′ E, 7–13 m; R. E. Schroeder; 3 July 1979. ANSP 164646, 152 mm; Mindanao, Zamboanga Del Norte, W side of Solino (Selinog) Island, 08° 51′ 42″ N, 123° 24′ 36″ E, 0–4.6 m; L. Knapp et al., LK79-10; 4 May 1979. ANSP 177712, 7:115–152 mm, and ANSP 177769, 174 mm; Mindanao, Zamboanga del Norte, W side of Solino (Selinog) Island, 08° 51′ 24″ N, 123° 24′ 36″ E, 0–4.6 m; L. Knapp et al.; 3 May 1979. ANSP 177775, 2:151–156 mm, taken with the holotype. CAS 52575, 130 mm; Sulu Province, Siluag Island; A. W. Herre; 23 June 1948. SU 26801, 118 mm; Negros Oriental, Dumaguete, A. W. Herre; June 1931. USNM 357432, 2:115–124 mm; Palawan Province, Sulu Sea, Puerto Princesa Bay, Pagnagtaran Point, 09° 44′ N, 118° 45′ E, 7–13 m; R. E. Schroeder; 2 July 1979. INDONESIA: ANSP 131300, 4:93–126 mm; Mentawei Islands, off Pulu Siburu, 02° 00′ S, 99° 35′ 40″ E, 1–2 m; *Te Vega* Cruise A, sta. 104; 30 November 1963. MOLUCCA STRAITS: ANSP 138523, 125 mm; Pulo Jarak, 03° 59′ N, 100° 06′ E, 0–4 m; *Te Vega* Cruise A, sta. 71; 30 October 1963. THAILAND: South China Sea: ANSP 131179,

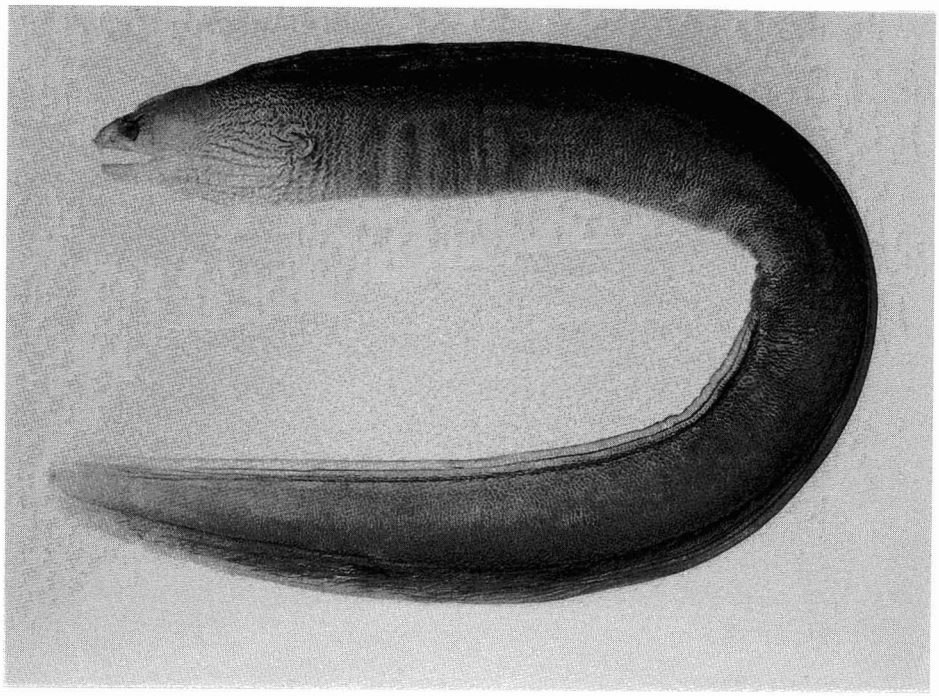

FIGURE 7. *Gymnothorax pseudoherrei,* BPBM 33328, paratype, 292 mm TL (photo by J. E. Randall).

10:73–163 mm; Goh Huyong, Similar Islands coral heads, 08° 29′ N, 97° 39′ E, 2–5 m; *Te Vega* Cruise A, sta. 78; 3 November 1963. SRI LANKA: ANSP 138609, 2:46–122 mm; Trincomalee, S side of bay N of harbor, 10–22 m; C. C. Koenig, CCK69-135; 4 April 1970. ANSP 138701, 111 mm; Hikkaduwa, 1 mile N of resthouse, 15 m; C. C. Koenig, CCK69-102; 13 February 1970. MCZ 46958, 2:140–166 mm; Trincomalee Bay; C. C. Koenig, CCK69-134; 3 April 1970. USNM 357433, 3:117–155 mm; coral heads SE side of bay at Galle; C. C. Koenig, CCK69-108; 16 February 1970. MALDIVES: CAS 35657, 5:66–141 mm; Male Atoll, E side of Hulele Island on outer reef, 04° 11′ 30″ N, 73° 31′ 00″ E; *Te Vega* Cruise 5; 8 November 1964. CAS 52094, 102 mm; Male Atoll, 04° 11′ 30″ N, 73° 31′ 00″ E; *Te Vega* Cruise 5; 8 November 1964. FMNH 75523, 123 mm; Miladumadulu Atoll, SW shore Kendikolu Island. 05° 56′ 30″ N, 73° 24′ 00″ E; L. P. Woods et al., LW64-28; 27 March 1964. FMNH 75540, 4:123–134 mm; Tiladummati Atoll, Filadu Island; Beardsley et al., LW64-29; 31 March 1964. OMAN: BPBM 21473, 210 mm; off village of Doha, S side of harbor of Mutrah, 1–3 m; J. E. Randall; 17 March 1977. ROM 40446, 217 mm; Kalhat (Qualhat), 50 m N of tip of gravel spit at outlet of Kalmat Wadi, 22° 42′ 90″ N, 59° 25′ 90″ E; B. N. G. Simm; 5 June 1981. ROM 40447, 247 mm; 5 miles SE of town adjacent to second beach that breaks the line of cliffs, 22° 33′ 90″ N, 59° 36′ 30″ E; B. N. G. Simm; 4 November 1981. ROM 40646, 3:51–55 mm; Kalhat (Qualhat), 1 mile NW of end of wadi, 200 m before start of cliffs, 22° 43′ 90″ N, 59° 22′ 90″ E; B. N. G. Simm; 23 January 1981. PERSIAN GULF: Saudi Arabia: BPBM 33328, 1:292 mm; W side Jana Island on reef flat, 1.5 m; J. E. Randall et al.; 13 September 1985. BPBM 33356, 3:210–258 mm; SE side Jana Island, 16.8 m; J. E. Randall et al.; 13 September 1985. RED SEA: HUJ 15110, 2:185–193 mm; Remia; 29 March 1962.

DIAGNOSIS: A small, elongate, uniform brown moray with anus before midbody, preanal length 2.0–2.3 in TL; head 7.2–9.0 in TL; depth at gill opening 14–20 in TL; 2 branchial pores; teeth numerous and smooth, maxillary teeth biserial for entire extent, vomerine teeth uniserial, dentary teeth biserial in young, uniserial in adults; MVF 6-47-114.

MEASUREMENTS (IN MM) AND COUNTS OF THE HOLOTYPE: TL 147; preanal length 68; HL 17.3; snout to dorsal origin 15.5; depth at gill opening 8.8; depth at anus 7.3; length of upper jaw 5.5; length of lower jaw 5.0; snout length 3.0; eye diameter 2.0; width interorbit 2.5. Predorsal vertebrae 5; preanal vertebrae 47; total vertebrae 114. Head pores: branchial 2; supraorbital 1 + 2; infraorbital 4; mandibular 6. Teeth: outer intermaxillary 8–8, median intermaxillary 2; inner maxillary 12–13, outer maxillary 22–21; vomerine 9; main dentary 21–19, outer dentary 15–14. A female with 0.9-mm eggs.

DESCRIPTION [Range of proportions for holotype and 19 paratypes, followed by the value for the holotype in parentheses]: A small, elongate species, depth at gill opening 14–20 (17), depth at anus 16–26 (20) in TL; anus before midbody, preanal length 2.0–2.3 (2.2) in TL. Head moderately elongate, 7.2–9.0 (8.5) in TL; snout moderately short, 4.9–6.8 (5.8) in HL; jaws subequal, upper jaw longer, 2.6–3.2 (3.1) in HL. Eye moderately large, 8.2–12 (8.7) in HL, closer to rictus than to snout tip. Anterior nostril in moderate tube, not reaching jaw edge; posterior nostril above anterior eye, with raised crenulate rim. Two branchial pores above and before gill opening; other head pores as listed for holotype. Dorsal-fin origin before gill opening, closer to gill opening than to rictus, usually above second branchial pore. Gill opening a diagonal slit at midside (Figure 2*F*). Predorsal vertebrae 5–9, preanal vertebrae 44–50, total vertebrae 110–118; MVF 6-47-114 (66).

Teeth numerous, smooth, short, and stout, with ontogenetic variation in dentary teeth, no sexual dimorphism apparent (Figure 3*D*). Intermaxillary teeth in 3 rows; 6–8 peripheral teeth, the posterior ones large and stout; two short, stout median teeth. Maxillary teeth biserial for entire extent, the rows extending almost to rictus; inner row of 8–21 long, triangular teeth, outer row of 17–30 short, close-set teeth. Vomerine teeth 7–12, short, sharp, and uniserial, sometimes staggered. Dentary teeth biserial in small specimens, mostly uniserial in large individuals. Main inner row of 15–26 stout, triangular dentary teeth decreasing in size posteriorly; outer row of 8–22 short, close-set teeth in small specimens (<180 mm), extending nearly to or as far as inner row, 3–7 anterior teeth only in larger specimens.

Body and fins medium to dark brown. Head usually pale; no dark ring around eye, head pores with narrow brown rims. Body frequently covered with mucus.

DISTRIBUTION: Taken off the western Pacific islands of the Philippines, the Solomons, the Great Barrier Reef, and Molucca Straits, and from the northwestern Indian Ocean, the Persian Gulf, and the Red Sea, in shallow waters at depths to 7 m. The Persian Gulf and Red Sea specimens are larger than the others.

REMARKS: *Gymnothorax pseudoherrei* is a small species; the largest paratype is 292 mm TL. Matures at a small size; of six females (123–248 mm), three (123–149 mm) are ripe with 1.7- to 2.0-mm eggs; eight specimens (140–292 mm) are males.

This species is very similar to *Gymnothorax herrei,* and specimens have recently been identified as that species. Both are small, dark brown morays with pale heads, frequently covered with mucus, and they have similar body proportions. However, *G. herrei* has only one branchial pore, the dorsal-fin origin noticeably farther back over or behind the gill opening, and an additional outer row of 5–12 small, rounded intermaxillary teeth. The two species overlap in the western Pacific and eastern Indian Ocean, but *G. herrei* has not been found west of Sri Lanka. *Gymnothorax atolli* and *G. australicola* have one branchial pore and serrate teeth; neither are known from the western Pacific or the Indian Ocean.

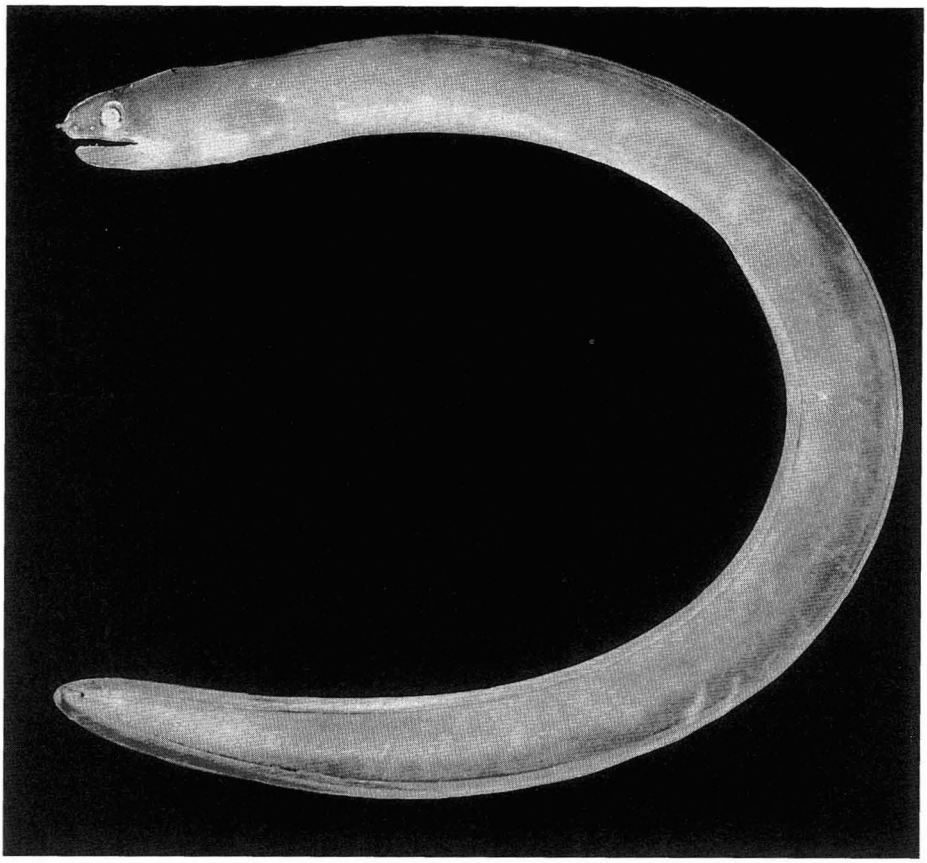

FIGURE 8. *Gymnothorax kontodontos,* ANSP 177771, holotype, 174 mm TL (photo by J. E. Randall).

ETYMOLOGY: From the Greek *pseudes* (false) and *herrei,* the name for the small brown moray that it superficially resembles and has previously been identified as. To be treated as a noun in apposition.

Gymnothorax kontodontos Böhlke, n. sp.
Short-tooth moray
Figures 2*G*, 3*E*, 8; Table 1

Siderea sp. Kosaki et al., 1991:187 (Johnston Island).

TYPE MATERIAL: Holotype: ANSP 177771, 174 mm TL, male; Line Islands, Fanning Island, outside reef 300 yards NW of entrance to English Harbor, chemfish at 6 m; J. Randall, J. McVey, W. Hashimoto, B. Jennions; 31 October 1968. Paratypes: Eight paratypes, 121–179 mm TL. LINE ISLANDS: BPBM 9392, 2:133–156 mm; taken with the holotype. JOHNSTON ATOLL: BPBM 33391, 1:121 mm; N side, outside reef N of Mustin Channel, rotenone at 10–15 m; R. L. Pyle, R. K. Kosaki, S. C. Jazwinski; 10–12 June 1988. BPBM 37448, 1:164; R. K. Kosaki, D. K. Irons; 25 July 1989. CORAL SEA: BPBM 31780, 1:158 mm, Bougainville Reef, cave in SW side, rotenone at 24–26 m; J. E. Randall; 31 January 1987. NEW GUINEA: USNM 357423, 1:179 mm; Massas Island, S tip; 05° 10′ 18″ S, 145° 51′ 24″ E, 0–18 m; V. G. Springer et al., VGS78-21; 6 November 1978. CHAGOS ARCHIPELAGO: ROM 38924, 1:149 mm; Salomon Atoll, near pass

at NW end of Isle Anglaise on outer reef top, 05° 18′ 53″ S, 72° 13′ 54″ E, 24–27 m; R. Winterbottom, WE79-97; 25 March 1979. COMORES: ROM 57311 mm, 1:177; Moheli, NW coast of Chissiona Dzaha, 12° 23′ 52″ S, 43° 39′ 23.5″ E, 12–20 m; R. Winterbottom et al., RW88-41; 26 November 1988.

DIAGNOSIS: A small moray with pale coloration; anus well before midbody, preanal length 2.5–2.8 in TL; head blunt and rounded, 8.3–9.7 in TL, gape short; depth at gill opening 16–20 in TL; 2 branchial pores; teeth short and smooth, maxillary teeth triserial, vomerine teeth biserial, dentary teeth uniserial to biserial; MVF 8-42-131.

MEASUREMENTS (IN MM) AND COUNTS OF THE HOLOTYPE: TL 174; preanal length 64; HL 19.1; snout to dorsal-fin origin 19.8; depth at gill opening 8.8; depth at anus 8.0; length of upper jaw 7.2; length of lower jaw 6.3; snout 4.1; eye diameter 2.6; width interorbit 3.7. Predorsal vertebrae 7; preanal vertebrae 40; total vertebrae 130. Head pores: branchial 2; supraorbital 1+2; infraorbital 4; mandibular 6. Teeth: outer intermaxillary 6–6, median intermaxillary 2; inner maxillary 8–9, middle maxillary 10–10, outer maxillary 14+–20; vomerine 15, biserial medially; main row dentary 22, 6–8 outer. A male.

DESCRIPTION [Range of proportions given for holotype and 8 paratypes, followed by the value for the holotype in parentheses]: A small, moderately elongate species, depth at gill openings 16–20 (20), depth at anus 18–22 (22) in TL; anus well before midbody, preanal length 2.5–2.8 (2.7) in TL. Head short, 8.3–9.7 (9.1) in TL; snout short and bulbous, overhanging lower jaw, its length 4.6–5.4 (4.7) in HL; jaws short, extending little beyond posterior eye margin, lower jaw shorter than upper, upper jaw length 2.5–3.0 (2.7) in HL; lips papillose. Eye large, 7.0–8.5 (7.4) in HL, its posterior margin just before rictus. Anterior nostril in moderate tube, just reaching lip; posterior nostril above mideye, with raised crenulate rim. Two branchial pores, the posterior pore above gill opening; other head pores as listed for holotype. Dorsal-fin origin above gill opening or slightly behind, behind second branchial pore. Gill opening at midside (Figure 2*G*). Predorsal vertebrae 7–9, preanal vertebrae 40–43, total vertebrae 126–135; MVF 8-42-131 (9).

Teeth numerous and smooth, short and stout, some rounded, no long canines; maxillary teeth triserial, vomerine teeth bi- or triserial (Figure 3*E*). Outer premaxillary teeth usually 6-1-6, the median and anterior three on each side short and stout, the posterior three large, triangular, and canted back; two stout median teeth, the second longer. Maxillae very short and broad, ending just below posterior eye margin, teeth triserial; inner row of 9–13 moderately tall, slender, well-spaced teeth, shorter middle row of 8–15 short, sharp teeth, outer row of 12–24 very small teeth. Vomerine teeth biserial to triserial for most of their extent, uniserial far posteriorly, a total of 14–30 short, stout teeth. Dentary teeth uniserial to biserial; small individuals with main row of about 25, the anterior 4–5 large and stout, continuing as irregular row of 16–20 smaller teeth, and outer anterior row of 7–9 small teeth; large specimens with main row of 19–20 teeth, the anterior 4–5 notably larger, and outer row of 23–29 smaller teeth. Ripe females with numerous teeth, vomerine teeth partially triserial.

Coloration uniform, appearing as pale yellowish to pale tan, the fins paler; small brown pigment spots are visible microscopically on the head and body, the spots fewer or lacking on the fins. Dark pigment around anterior eye of larger specimens; head pores with pale rims. Color of a live specimen (ANSP 177771) said to be dark brown; on another (BPBM 9392) the posterior portion of tail appeared greenish.

DISTRIBUTION: Taken infrequently in the Line Islands, Johnston Island, the Coral Sea, New Guinea, Chagos Archipelago (reported as *Gymnothorax* sp. 1 in Winterbottom and Anderson [1997:3]), and Comoros Islands, at depths of 10–15 m.

REMARKS: *Gymnothorax kontodontos* is a small species, known only to 179 mm. Of the nine type specimens, five (133–179 mm) are females, with 0.7- to 1.4-mm eggs, and

FIGURE 9. *Gymnothorax microstictus,* ANSP 177776, paratype, 147 mm TL.

three are males (156–174 mm), the largest ripe.

The species is distinguished by a combination of characters: dorsal-fin origin above or behind gill opening, very long tail (67% TL), short maxillae with triserial dentition, and MVF of 8-42-131.

ETYMOLOGY: From the Greek *kontos* (short) and *odontos* (tooth), in reference to the very short, small teeth. To be treated as a noun in apposition.

Gymnothorax microstictus Böhlke, n. sp.
Small-spot moray
Figures 2*H*, 3*F*, 9; Table 1

TYPE MATERIAL: Holotype: USNM 357424, 172 mm TL, male; Papua New Guinea, Hermit Islands, N side of W entrance; V. G. Springer et al., VGS78-19; 4 November 1978. Paratypes: A total of 68 specimens, 39–213 mm TL. PAPUA NEW GUINEA: ANSP 144775, 2:141–164 mm; Hermit Islands, Amot Island; V. G. Springer, VGS78-12; 20 November 1978. ANSP 144777, 2:87–128 mm; Hermit Islands, Jalun Island, NE side, 1–15 m; V. G. Springer et al., VGS78-13; 1 November 1978. ANSP 144778, 17:39–170 mm; Hermit Islands, Jalun Island, E side, 0–33 m; V. G. Springer et al., VGS78-18; 2 November 1978. ANSP 177776, 4:129–147 mm; taken with the holotype. USNM 357425, 2:96–105 mm; Ninigo Islands, channel between Pelleluhu Group and Ninigo Group, 36 m; V. G. Springer et al., VGS78-5; 25 October 1978. USNM 357426, 5:94–182 mm; Hermit Islands, Pechu Island; P. West, VGS78-20; 5 November 1978. PHILIPPINES: ANSP 141362, 2:165–188 mm; Palawan Province, NNE side of Bararin Island (Cuyo Island), 0–17.4 m; V. G. Springer et al., SP78-21; 24 May 1978. ANSP 141368, 3:96–159 mm; and ANSP 177773, 1:184 mm; Mactan Island, Cebu, off E side, 0–30 m; V. G. Springer et al.; SP78-30; 3 June 1978. ANSP 141379, 1:111 mm; Balicasag Island, W side at drop-off, 09° 31′ 14″ N, 123° 40′ 00″ E, 0–24 m; V. G. Springer et al.; 10 June 1978. ANSP 141413,

2:126–155 mm; Balicasag Island, W side at drop-off, 09° 31′ 14″ N, 123° 40′ 00″ E, 0–41 m; V. G. Springer et al.; 11 June 1978. USNM 357428, 2:95–134 mm; Balicasag Island, W side at drop-off, 0–24 m; V. G. Springer et al., SP78-38; 10 June 1978. ANSP 141420, 1:76 mm; Palawan Province, W side Cocoreo Island, Cuyo Islands, 0–21 m; V. G. Springer et al., SP78-27; 26 May 1978. ANSP 141421, 1:97 mm; Oriental Negros, just off Bonbonon Point at S tip of island, 0–12 m; V. G. Springer et al., SP78-11; 13 May 1978. ANSP 144452, 1:176 mm; Palawan, Sulu Sea, Puerto Princesa, Pagnagtaran Point, 6–12 m; R. E. Schroeder; 2 July 1979. ANSP 144454, 1:90 mm; Palawan, Sulu Sea, Puerto Princesa Bay, reef 500 m W of reef off White Beach, 12 m; R. E. Schroeder; 14 November 1979. ANSP 144455, 2:158–168 mm; Palawan, Sulu Sea, Puerto Princesa Bay, White Beach reef, 12–18 m; R. E. Schroeder; 13 July 1979. ANSP 164934, 1:146 mm; Siquijor Island, ca. 2 km W of town of Siquijor, 24.4–30.5 m; L. Knapp et al., LK79-13; 14 May 1979. ANSP 164935, 9:89–188 mm; Cebu, Caceres Reef near Huisan Point; J. Libbey et al., JL-7; 18 May 1979. ROM 53466, 3:128–178 mm; Negros Oriental, Tanon Strait, mouth of Bais Bay; R. Winterbottom et al., RW87-23; 15 May 1987. USNM 357427, 2:180–213 mm; Pamilacan Island, off SW tip, 09° 29′ 20″ N, 123° 55′ 00″ E, 0–24 m; V. G. Springer et al., SP78-43; 12 June 1978. USNM 357429, 4:84–179 mm; Palawan, Sulu Sea, Puerto Princesa, reef off White Beach, 15 m; R. E. Schroeder; 14 November 1979. INDONESIA: BPBM 34165, 1:165 mm; Flores, Maumere Bay, reef off Sao Wisata Resort, 8 m; J. E. Randall; 19 September 1988.

DIAGNOSIS: A typically elongate, small brown moray with small dark spots on head, body, and fins; anus before midbody, preanal length 2.2–2.4 in TL; head short, 6.2–7.6 in TL; depth at gill opening 13–20; 2 branchial pores; teeth pointed and smooth, maxillary teeth uniserial in adults, vomerine and dentary teeth uniserial; MVF 4-41-117.

MEASUREMENTS (IN MM) AND COUNTS OF THE HOLOTYPE: TL 172; preanal length 74; HL 24.6; snout to dorsal-fin origin 20.6; depth at gill opening 12.1; depth at anus 9.0; length of upper jaw 9.0; length of lower jaw 9.0; snout length 4.7; eye diameter 3.0; width interorbital 3.7. Predorsal vertebrae 5; preanal vertebrae 40; total vertebrae 115. Head pores: branchial 2; supraorbital 1+2; infraorbital 4; mandibular 6. Teeth: outer intermaxillary 9–9, median intermaxillary 2; inner maxillary 4–2, outer maxillary 15–15; vomerine 16?; main dentary 24–26, inner dentary 0–2. A male.

DESCRIPTION [Range of proportions given for holotype and 19 paratypes, followed by the value for the holotype in parentheses]: A small moray with tapering tail; depth at gill opening 13–20 (14), depth at anus 16–22 (19) in TL; anus before midbody, preanal length 2.2–2.4 (2.3) in TL. Head long, 6.2–7.6 (7.0) in TL; snout moderate, pointed, and overhanging lower jaw, 4.9–6.4 (5.2) in HL. Jaws moderate, upper jaw 2.6–3.0 (2.7) in HL; eye very large, 7.2–8.7 (8.2) in HL, closer to rictus than to tip of snout. Anterior nostril in moderate tube; posterior nostril with crenulate margin above anterior margin of eye. Two branchial pores above and before gill opening; other head pores as listed for holotype. Dorsal-fin origin above or before first branchial pore. Gill opening a diagonal slit at midside (Figure 2*H*). Predorsal vertebrae 4–5, preanal vertebrae 40–44, total vertebrae 113–121; MVF 5-42-117 (36).

Teeth triangular and smooth, uniserial in large specimens, no long canines (Figure 3*F*). Outer intermaxillary teeth 7–9 (usually 9), the anterior 3 short, the posterior ones large, stout, triangular, and canted back; 2 teeth on midline, the first short and stout, the second stout and long. Maxillary teeth biserial in small specimens, inner teeth few or lacking in larger specimens; 0–7 tall, slender inner teeth, 10–18 shorter, sharp, triangular outer teeth, only the posterior 3–4 smaller. Vomerine teeth very short, 9–13 in one row. On dentary, main row of 21–31 teeth, the first 3 large, continuing teeth moderate, sharp and triangular, canted back, decreasing slightly in size posteriorly. Some specimens with 1–7 short, rounded, close-set outer anterior teeth.

Background color medium reddish brown, with close-set but not overlapping small, dark brown spots on body and tail. Fins dark grayish brown, becoming darker posteriorly; fins of large specimens sometimes spotted. Head uniform brown; incomplete narrow eye ring; anterior nostril dark distally; posterior nostril and head pores with brown pigmented rims. Many specimens with pale slashes between lateral-line papillae.

DISTRIBUTION: Taken in New Guinea and the Philippines, and a single specimen obtained at Flores, Indonesia; evidently not a shallow-water species, recorded from depths to 33 m.

REMARKS: *Gymnothorax microstictus* is a small species; the largest specimen is 213 mm. Maturing at small sizes; of nine females (146–184 mm), seven are ripe with 0.5- to 2.0-mm eggs; four (164–188 mm) are males.

This species is distinguished by its small size, the reddish brown color with small, dark brown spots on body and tail, and dark grayish fins; and by its few vertebrae. Very small specimens of *Gymnothorax flavimarginatus* have similar spotted coloration, but the fins have a pale margin (at least posteriorly), the gill opening is dark, and they possess more vertebrae (MVF 5-58-136).

ETYMOLOGY: From the Greek *mikros* (small) and *stiktos* (spots), in reference to the small spots. A noun in apposition.

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